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09/924,120

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Mitsuru Sekiguchi

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05/21/2003

NIXON PEABODY, LLP  
8180 GREENSBORO DRIVE  
SUITE 800  
MCLEAN, VA 22102

EXAMINER

GURLEY, LYNNE ANN

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 05/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**Application No.  
**09/924,120**Applicant(s)  
**Sekiguchi et al.**Examiner  
**Lynne Gurley**Art Unit  
**2812**

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.138 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on Mar 4, 2003
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-6, 21, 22, 24, and 32-38 is/are pending in the application.
- 4a) Of the above, claim(s) 1-6 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 21, 22, 24, and 32-38 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some\* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-949)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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## **DETAILED ACTION**

### ***Priority***

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Specification***

2. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

### ***Claim Rejections - 35 USC § 112***

3. Claims 21-22, 24, and 32-34 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically, it is not clear how the statement that "the conductivity [of the metal of the barrier film] will not be lost when the metal is oxidized" is enabled. When the metal is oxidized, its specific resistance is increased as Applicant denotes in the specification. This also results in a decreased conductivity. So that the conductivity is lost to a degree. Perhaps

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what is meant is that within a range of conductivity, the conductivity is not considered to decrease by a large amount in comparison to some other metals. Clarification is required.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 21-22, 24 and 32-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the statement that “the conductivity [of the metal of the barrier film] will not be lost when the metal is oxidized” is indefinite and fails to particularly point out and to distinctly claim Applicant’s invention. When the metal is oxidized, its specific resistance is increased as Applicant denotes in the specification. This also results in a decreased conductivity. So that the conductivity is lost to a degree. Perhaps what is meant is that within a range of conductivity, the conductivity is not considered to decrease by a large amount in comparison to some other metals. Clarification is required.

Additionally, a period is missing at the end of claim 4.

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

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(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

7. The rejection of claims 21-22 and 24 under 35 U.S.C. 102(a/e) as being anticipated by Soininen et al. (US 2002/0004293, dated 1/10/02, filed 5/15/01) has been maintained for the reasons of record and further made to encompass rejection of claims 33 and 35-37.

Soininen shows the method as claimed in figure 1 and corresponding text, as a substrate 2,4, a barrier metal/seed layer 16 which can be made of Ru or Ir or their oxides and a conductive film 18 of copper which is in contact with the barrier metal film. Note that even though the layer 16 is not referenced as a barrier layer, its function inherently serves such a purpose since it is a physically present layer which separates the copper layer 18 from the substrate in addition to the layer 14. It will also prevent some of the copper diffusion. Also, since this layer is made of the same materials that Applicant is claiming as a barrier layer, it should also inherently serve as such.

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A dual damascene contact structure is formed on the substrate and the recess is buried within the contact, forming an embedded wiring composed of the conductive film. The barrier metal also functions as a seed layer and can be partially metal and partially oxide (pages 3-4, paragraphs [0057-0058]). Also, see page 3, paragraph [0045] and page 4, paragraphs [0067] and [0068].

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was

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commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 32, 34 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soininen et al. (US 2002/0004293, dated 1/10/02, filed 5/15/01).

a. Soininen shows the method substantially as claimed, and as described in the preceding paragraphs.

Soininen lacks anticipation only in not teaching that: 1) in the step of forming the conductive film, the metal composing the barrier metal film is oxidized to form a metal oxide; and 2) after forming the conductive film, the upper-layer wiring is formed by etching the conductive film using a mask pattern covering the wiring forming region.

It would have been obvious to one of ordinary skill in the art that the barrier metal film would be partially oxidized in the step of forming the conductive film in the method of Soininen, with the motivation that in transporting the wafer to the electroplating chamber from the ALD apparatus, the wafer would be exposed to the ambient which would cause subsequent oxidation of the barrier metal film.

It would have also been obvious to one of ordinary skill in the art to have deposited the conductive film using a mask to create an upper-electrode extending above the surface of the

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trench level insulator if needed to for connection to another part of the circuit and then used an etch to pattern the resulting interconnect.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

#### ***Response to Arguments***

Applicant's arguments filed 3/4/03 have been fully considered but they are not persuasive. In response to Applicant's remarks, pages 3-7 of the amendment, filed 3/4/03, claim 32 has been addressed and rejected as listed on the summary form in the previous office action. While Applicant's remarks are understood, the barrier layer and seed layers are not specifically claimed as being separate layers. Therefore, the prior art remains valid. Additionally, the claims should be



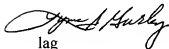
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addressed in regard to the conductivity not being lost when the metal is oxidized. This is not an entirely accurate statement as claimed and as described in Applicant's specification. The conductivity is lost in part. Care should be taken to amend the claims to state what is truly regarded as the Applicant's invention.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is (703) 305-3474. The examiner can normally be reached on Monday-Friday from 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John F. Niebling, can be reached on (703) 308-3325. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



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John F. Niebling  
Supervisory Patent Examiner  
Technology Center 2800

May 15, 2003